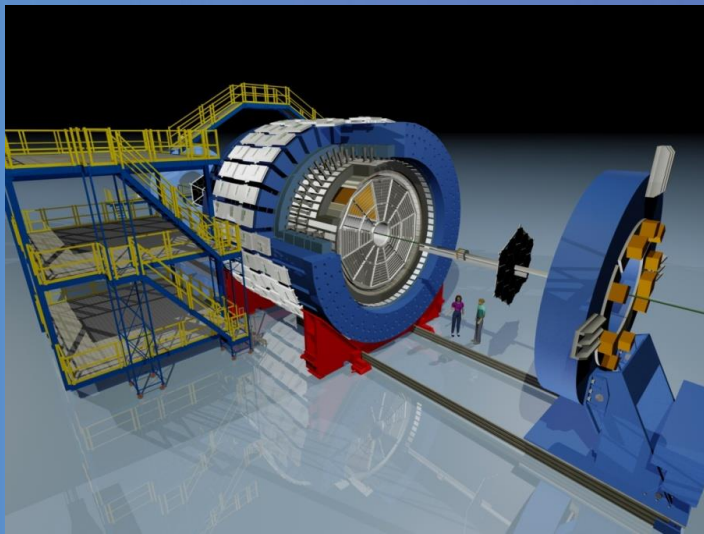


# STAR REQUEST TO EXTEND THE PP RUNNING BY TWO WEEKS (OR 10 DAYS)

*Bill Christie*

*For the STAR Collaboration*

*MARCH 24, 2015*



**BROOKHAVEN**  
NATIONAL LABORATORY


*a passion for discovery*



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science

# STAR IS RUNNING MULTIPLE PP PHYSICS PROGRAMS



**STAR.DAQ**

Menu

- Monitoring
- Rate Charts
- Current Rates
- LED Status
- Slow Controls
- Current RunLog
- Today's ShiftLog
- Critical Support
- BERT
- TPC Temperature
- TPC Anode Scan
- TPC DAQ10K
- DAQ Plots

Status

**RUNNING**

16083018

Auto Update

☒ 5 s Now

11357

Run Playback

00000000 1

< >

online 3:3

**RUNNING [to RCF] 16083018**

production\_pp200trans\_2015 [PHYSICS]

Ready for Physics

Physics ON (436m) [Keep Beam]

In progress...

Run started Tue Mar 24 08:47:57 2015

Duration 0 days, 0 hr, 23 min, 38 s

Blue 100.1 GeV, 19436 ions, Physics Running

Yellow 100.1 GeV, 21048 ions, Physics Running

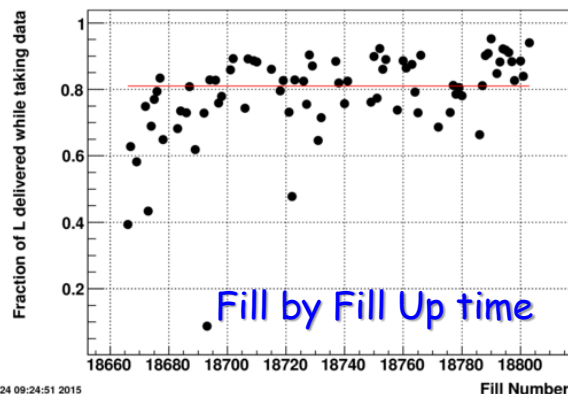
TCU Clock 9383147.0

Trigger	DAQ Evt	DAQ Hz	L0 Evt	L0 Hz	Sca Hz	Sca Dead	Built	Xpress	Abt	Err	Trigger	DAQ Evt	DAQ Hz	L0 Evt	L0 Hz	Sca Hz	Sca Dead	Built	Xpress	Abt	Err
<a href="#">RP_SD</a>	8378	7	8379	6	722208.7	22 %	8377	8377	0	1	<a href="#">BHT1*VPDDB-30</a>	199662	152	199745	156	184	17 %	199662	0	0	0
<a href="#">RP_SDT</a>	32961	22	32974	24	83066.1	22 %	32960	32960	0	1	<a href="#">BHT0*BBCMB</a>	1929	1	1930	1	10159	11 %	1929	0	0	0
<a href="#">RP_RPZMU</a>	5580	3	5584	5	5	0 %	5580	5580	0	0	<a href="#">BHT1*BBCMB</a>	1835	1	1836	1	1637	11 %	1835	0	0	0
<a href="#">RP_RPZE</a>	3247	3	3249	3	4	25 %	3247	3247	0	0	<a href="#">BHT2*BBCMB</a>	100959	61	100994	64	76	8 %	100959	0	0	0
<a href="#">RP_RP2MU</a>	6046	2	6048	2	7	29 %	6046	6046	0	0	<a href="#">singlemuon-5</a>	48794	38	48810	37	411	12 %	48794	48794	0	0
<a href="#">RP_RP2E</a>	6221	2	6223	4	8	25 %	6221	6221	0	0	<a href="#">emuon-30</a>	35026	23	35043	29	37	11 %	35026	35026	0	0
<a href="#">RP_CPT2</a>	313386	222	313509	241	1457	20 %	313383	313383	0	3	<a href="#">dimuon</a>	106804	66	106831	62	89	10 %	106803	106803	0	1
<a href="#">RP_ET</a>	57505	37	57513	40	154536.1	18 %	57504	57504	0	1	<a href="#">bbc-mtdcosmic</a>	11544	8	11548	9	1048	10 %	11544	11544	0	0
<a href="#">RP_CP</a>	42167	26	42185	31	174302.2	22 %	42165	42165	0	2	<a href="#">FMS-sm-bs1</a>	71966	47	71978	51	3162	8 %	71966	71966	0	0
<a href="#">RP_Zerobias</a>	1156	1	1156	1	9383145	22 %	1155	1155	0	1	<a href="#">FMS-sm-bs2</a>	193254	127	193276	124	307	7 %	193253	193253	0	1
<a href="#">RP_CPEI</a>	9336	6	9339	6	940	22 %	9336	9336	0	0	<a href="#">FMS-sm-bs3</a>	188594	123	188610	116	123	8 %	188594	188594	0	0
<a href="#">BHT1*VPDDB-30-nobsmd</a>	221362	168	221452	168	184	10 %	221362	0	0	0	<a href="#">FMS-lq-bs1</a>	72292	54	72301	51	13222	8 %	72292	72292	0	0
<a href="#">JP2</a>	272591	207	272715	238	256	10 %	272587	0	0	4	<a href="#">FMS-lq-bs2</a>	139761	103	139776	98	1630	8 %	139761	139761	0	0
<a href="#">JP2-bsmd</a>	246336	189	246447	216	256	17 %	246332	0	0	4	<a href="#">FMS-lq-bs3</a>	230211	179	230240	186	181	10 %	230211	230211	0	0
<a href="#">AJP</a>	4557	4	4559	3	253	15 %	4557	0	0	0	<a href="#">FMS-DIBS</a>	125270	88	125285	96	115	10 %	125269	125269	0	1
<a href="#">EHT0</a>	30433	26	30448	27	32	9 %	30433	0	0	0	<a href="#">FMS-JP2</a>	135072	105	135081	100	105	9 %	135072	135072	0	0
<a href="#">JP1</a>	400227	275	400386	303	1790	21 %	400225	0	0	2	<a href="#">FMS-JP1</a>	383609	262	383663	275	711	9 %	383609	383609	0	0
<a href="#">JP2*L2JetHigh</a>	272591	207	272715	238	256	10 %	272587	0	0	4	<a href="#">FMS-JP0</a>	76011	56	76021	52	7270	8 %	76010	76010	0	1
<a href="#">EHT0*EJP1*L2Egamma</a>	25923	23	25936	24	28	11 %	25923	0	0	0	<a href="#">FMS-DIJP</a>	37273	19	37277	21	32	19 %	37273	37273	0	0
<a href="#">BHT2*BJP1*L2Bgamma</a>	87842	49	87874	54	76	14 %	87842	0	0	0	<a href="#">FMS-LED</a>	1242	1	1242	1	1	0 %	1242	1242	0	0
<a href="#">VPDDB-5-trqonly</a>	4968	4	4968	3	25675	8 %	4968	0	0	0	<a href="#">VPDDB-novtx</a>	1809	1	1810	1	423078.4	11 %	1808	0	0	1
<a href="#">VPDDB-5-ssd</a>	636837	444	637102	474	25675	56 %	636835	636835	0	2	<a href="#">ZDCMB-trqonly</a>	2944	2	2944	2	2939	7 %	2944	0	0	0
<a href="#">BBCMB</a>	1031	1	1031	1	1195761.1	12 %	1030	0	0	1	<a href="#">VPDDB-30</a>	1239	1	1239	1	150921.1	11 %	1238	0	0	1
<a href="#">BHT0*VPDDB-5</a>	24342	20	24350	17	200	8 %	24342	0	0	0	<a href="#">ZEROBias</a>	978	2	979	1	9383145	65 %	977	977	0	1
<b>ALL</b>	<b>3483182</b>	<b>2528</b>	<b>3483558</b>	<b>2549</b>	<b>9383145</b>	<b>0 %</b>	<b>3482512</b>	<b>2980505</b>	<b>0</b>	<b>23</b>											

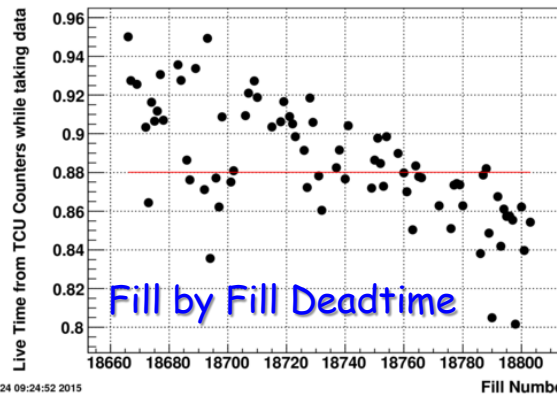
- Running 48 simultaneous Triggers
- Unpolarized measurements for HI comparison data
- Transverse pp program
- Longitudinal pp program
- Roman Pot program

# STAR IS RUNNING VERY WELL

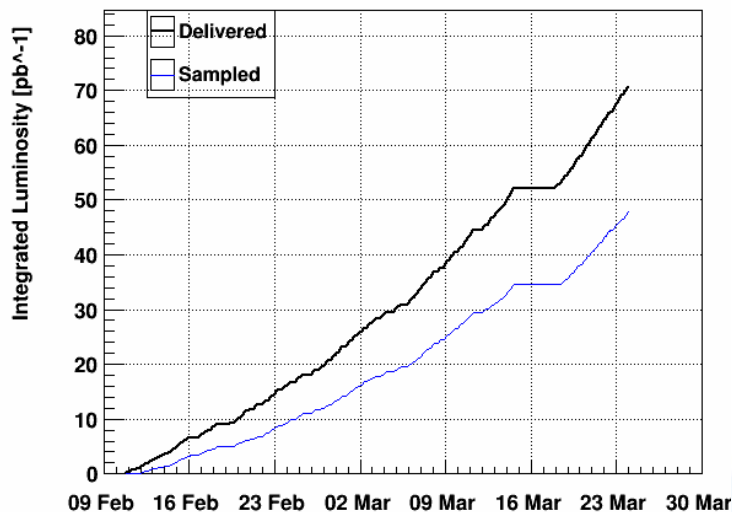
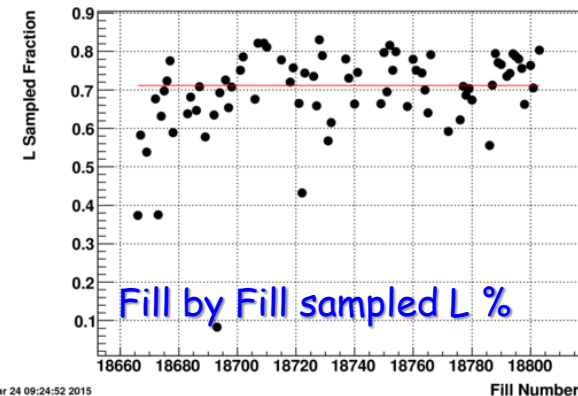
Fraction of L delivered while taking data



Live Time from TCU Counters while taking data



L Sampled Fraction

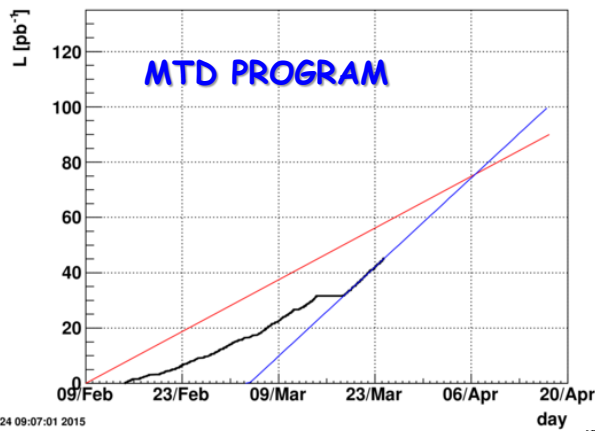


- STAR uptime is very good
- Deadtime running about 15%
- Sampled luminosity fraction very good

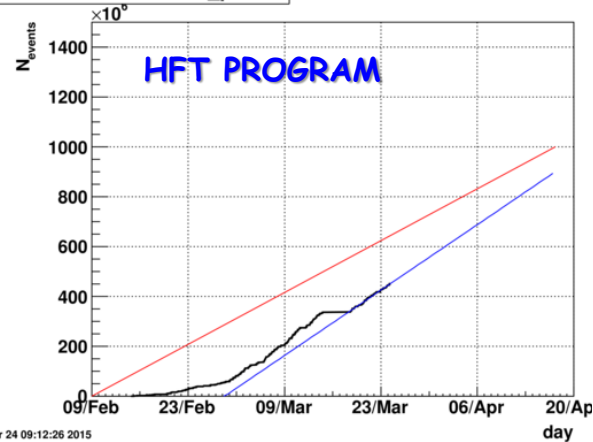
# CURRENT STATUS (UNPOLARIZED PROGRAM)

- UNPOLARIZED PHYSICS PROGRAMS ARE PROGRESSING pretty WELL

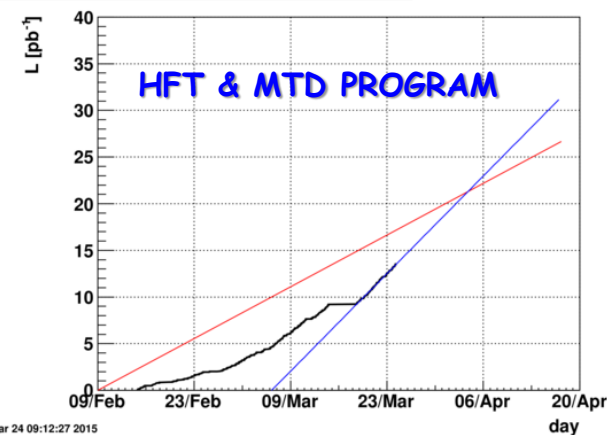
dimuon



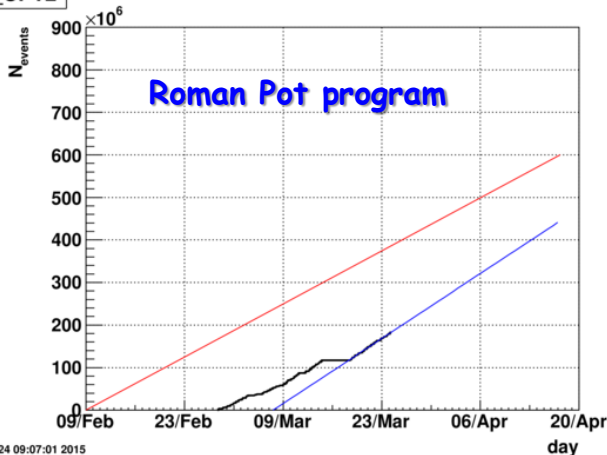
VPDMB-5-effective-sum\_pclist



BHT1\*VPDMB-30-nobsmd-effective\_pclist



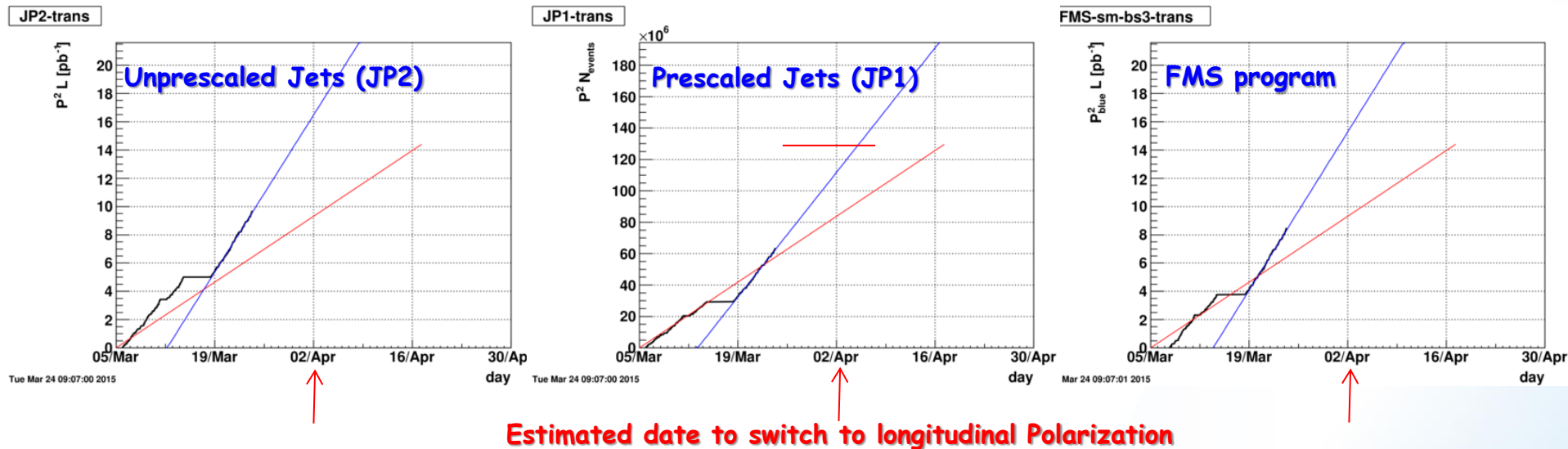
RP\_CPT2



- To reach our HFT data set goals, without an extension to the pp run, we'll have to cut into our Transverse pp data set goals (JP1), as well as our Roman Pot goal.
- Roman Pot goal (set during run) won't be met.



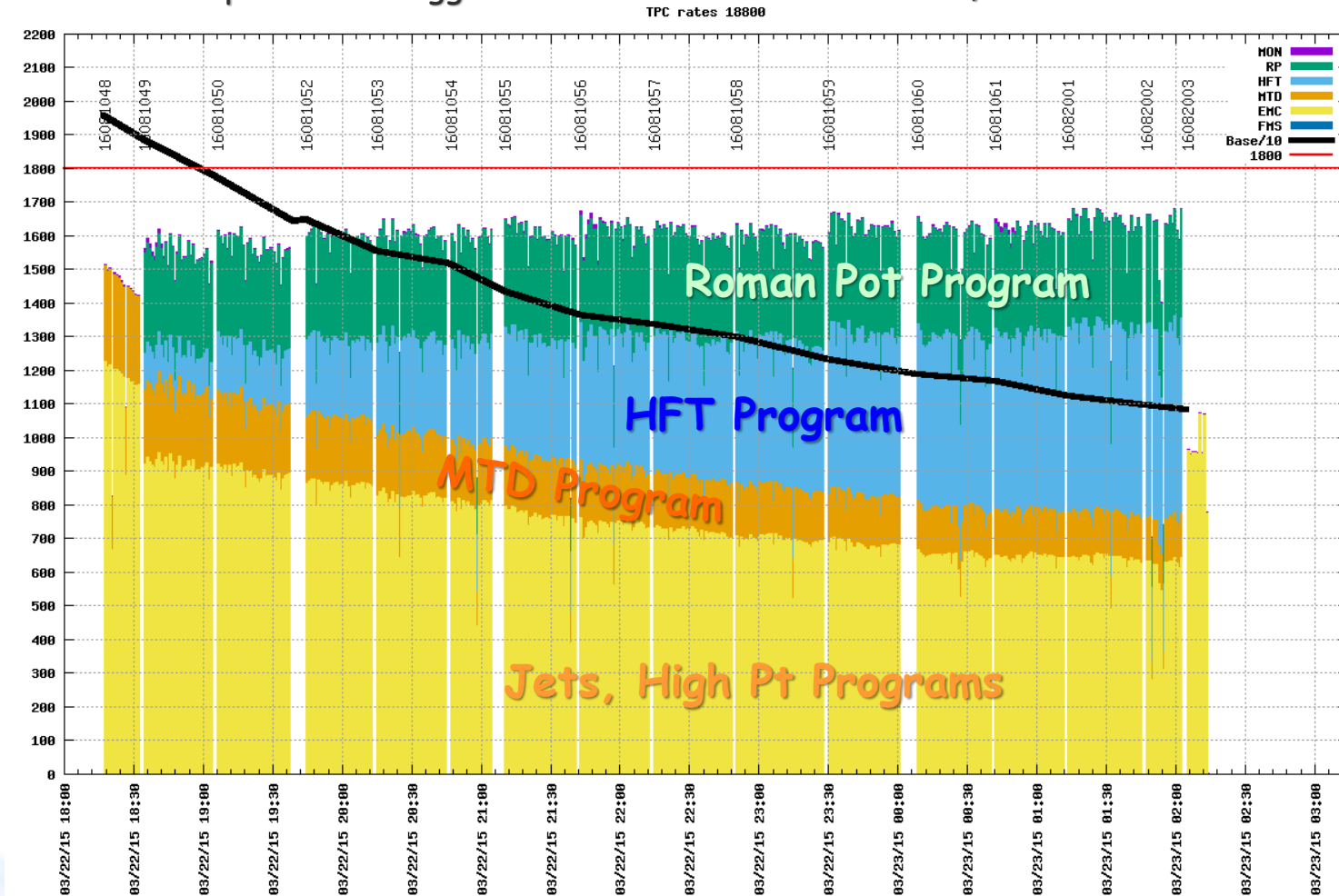
# CURRENT STATUS (TRANSVERSE PP PROGRAM)



- Due to excellent Collider performance STAR running efficiency, the Transverse data set goals are progressing very well. Assuming continued good performance, estimated date for switching to longitudinal polarization is **either coming out of the April 1<sup>st</sup> access, or 8 am Thursday April 2<sup>nd</sup>.**
- One data set goal that needs help to reach goal by this date is Jp1. Constrained by TPC rate limit and other program needs.

# BANDWIDTH CONSTRAINTS

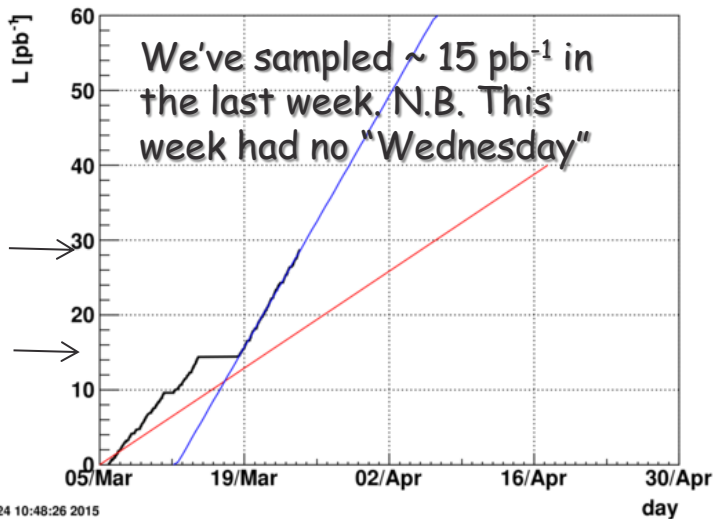
- Trigger Bandwidth constraint that we can take no more than 3 kevts per second
- TPC Bandwidth constraint that we can't take more than 1800 Hz of events with the TPC
- We've tuned prescaled triggers to maintain both total event, and TPC rates close to limits.



Without decision on extension we'll have to cut further into Transverse JP1 data set goal, and Roman Pots goal.

# ESTIMATE OF IMPACT OF 10 DAY EXTENSION

JP2-trans



- This past week has been extraordinarily good.
- An reasonable estimate is that we'll maintain 6/7 ths of this rate (account for "Wednesdays") for the remainder of the pp running. This gives about 12.8 to 13 pb<sup>-1</sup>/wk.

**Longitudinal goal is 50 pb<sup>-1</sup> with 60% polarization. FOM = 6.5 pb<sup>-1</sup>**

April						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2 Switch to Longitudinal 8 am	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17 Current pp end date	18
19	20	21	22	23	24	25
26	27 End pp run	28	29	30		

- If we switch on April 2<sup>nd</sup>, and run until Monday April 27<sup>th</sup> (10 day extension), and both RHIC and STAR maintain good performance, the estimate is that we'll accumulate ~ 44 pb<sup>-1</sup>.
- If we get ~ 40 pb<sup>-1</sup>, this will be double our Run 9 data set FOM, achieving the 200 GeV pp Delta G goals.
- See RHIC Spin White paper for physics impact.

# COMMENTS ON P-A RUNNING WITH 10 DAY PP EXTENSION

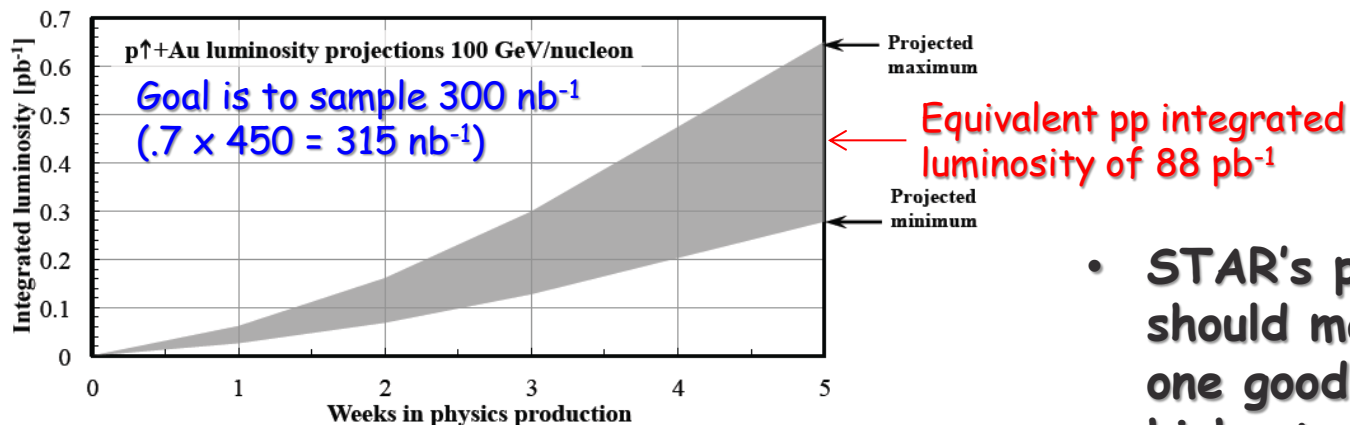
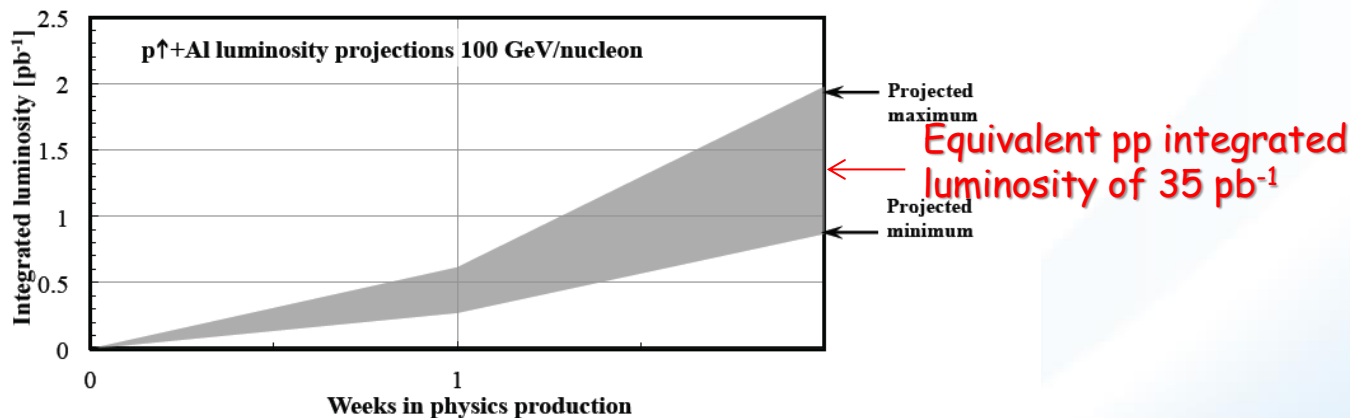


Figure 4: Projected minimum and maximum integrated luminosities for p+Au at 100 GeV/nucleon assuming linear weekly luminosity ramp-up in 4 weeks. The average store polarization of the proton beam expected to be close to the polarization achieved in the 100 GeV p+p run.

**p+Al at 100 GeV/nucleon** – Operation in this mode is similar to p+Al at 100 GeV/nucleon with some modifications to the lattice. The expected Al intensity has the same charge per bunch as was demonstrated with Cu ions in Run-12.



- STAR's position is that we should make sure that we get one good p-A data set as the highest priority.
- Consider a second p-A species only if p-Au goals achieved.



# SUMMARY

- Both RHIC and STAR are running very well.
- We estimate that, with a 10 day extension to the pp run, that we'll meet all of our unpolarized pp data set goals, all of our Transverse data set goals (Jp1 on edge), and get 80+% of our longitudinal data set goals.
- If we reach 80+% of our longitudinal data set goals, this in combination with our earlier pp data will achieve the 200 GeV Delta G measurement goals as listed in the RHIC Spin White paper.
- If we don't get this extension, we'll have to sacrifice part of our transverse spin goals, and our roman pot goals, to achieve our HFT goals. We'd achieve ~50% of our longitudinal spin goals.
- As far as the impact of the extension on the p-A program, STAR's position is that we have to accumulate a good p-Au data set before any consideration of a second p-A species.
- If we can't make this decision today, in an effort to reach our HFT goals, we request that the store lengths be increased immediately by 1 hour.

# ***ADDITIONAL MATERIAL***

# ***PAC RECOMMENDATIONS FOR RUN 15***

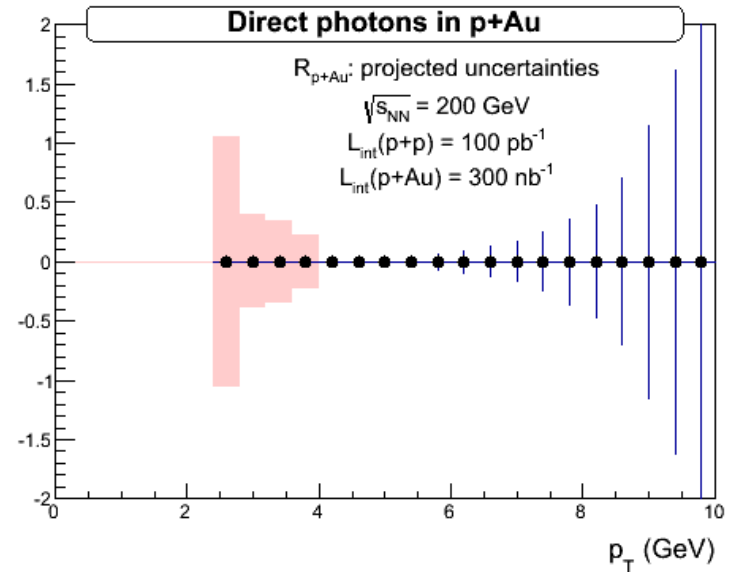
Within a 12-week p+p running scenario during Run 15, the STAR collaboration proposed a six-week run of p+p collisions with longitudinal polarization to improve the precision in measurements of the double-spin asymmetry  $ALL$  in inclusive jet and coincident di-jet production. These measurements would provide a definitive answer about the gluon contribution to the total spin of the proton if the current central value for  $\Delta g$  holds. Based on present day knowledge, the PAC expresses a preference for the improved  $\Delta g(x)$  measurement relative to the proposed transverse physics measurements.

The PAC recommends the 9 weeks of p+p running with the same priority as the 5 weeks of p+Au running. Both of these programs are recommended with higher priority than the two-week run with p+Si collisions.

# pA PHYSICS GOALS

Many pA physics goals involve ratios pA/pp  
 → need matched integrated luminosities

□  $R_{pA}$  for direct photons →  $g(x, Q^2)$  in A



□ Saturation physics:  
 $R_{pA}$  for  $A_N$  for  $\pi^0$   
 Di-hadron correlations for different  
 $p_{trig} > 2 \text{ GeV}$  and  $p_{trig} > 3 \text{ GeV}$  to  
 cross "saturation line"  
 Remember: at  $\eta > 2$  c.s.  $1/p_t^6$

